HONOLULU
LA JOLLA
MONTEREY
TIBURON

SOUTHWEST FISHERIES CENTER

MONTHLY REPORT - JUNE 1979

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NOAA/NMFS

Zooplankters that are in lagoon substrata during part of the diel cycle were trapped after they had emerged into the water column. Major forms included Tretomphalus sp. (foraminiferan), Polyophthalmus sp. (polychaete), Parasterope sp. (ostracod), Paramisophria sp. (calanoid copepod), a peltidiid (harpacticoid copepod), Cumella sp. (cumacean), Leptochelia sp. (tanaid), a eusirid (gammaridean amphipod), and Spadella sp. (chaetognath). Almost all of them enter the water column only at night, and have distinctive features adapted to their diurnal benthonic modes. Special attention was given to excluding zooplankters from the surrounding water, because this seems to have been a source of error in other recent studies that have attempted to quantify these emerging forms.

Translation

Uchida, Itaru. 1967. On the growth of the loggerhead turtle, Caretta caretta, under rearing conditions. Bull. Jpn. Soc. Sci. Fish. 33: 497-507. (Engl. transl. by Tamio Otsu, 1979, 18 p., Translation No. 36.) [Limited distribution]

Administrative Reports

Honolulu Laboratory

Wetherall, Jerry A., Fletcher V. Riggs, and Marian Y.Y. Yong. 1979. Assessment of the South Pacific albacore stock. SWFC Adm. Rep. H-79-6, 41 p.

_____. 1979. Some production model analyses of tuna and billfish stocks in the Indian Ocean. SWFC Adm. Rep. H-79-7, 49 p.

Yoshida, Howard O. 1979. Compilation of published estimates of tuna life history and population dynamics parameters. SWFC Adm. Rep. H-79-8, 30 p.

Aasted, Donald C. 1979. Guidelines for the operation of the research vessel Kaahele' Ale. SWFC Adm. Rep. H-79-9, 6 p.

La Jolla Laboratory

Bartoo, N., and E. Weber. Status of the north Pacific albacore stock from the yield-per-recruit and recruitment standpoints. Adm. Rep. No. LJ-79-15.

Bartoo, N., N. Beerman and G. Sakagawa. United States consumption and production of albacore. Adm. Rep. No. LJ-79-16.

Laurs, R.M. Results from north Pacific albacore tagging studies. Adm. Rep. No. LJ-79-17.

Perrin, W., N. Lo, and B. Wahlen. Progress in reducing incidental kill of dolphins in the U.S. tuna purse-seine fishery in the eastern tropical Pacific. Working paper for the meeting of the Subcommittee on Small Cetaceans of the Scientific Committee of International Whaling Commission. Adm. Rep. No. LJ-79-19.

Holts, D., R. McLain, F. Alverson, and J. DeBeer. The tuna/porpoise problem: dedicated vessel research program. Summary of the research results from the fifth cruise of the dedicated vessel, 11 November to 9 December 1978. Adm. Rep. No. LJ-79-20.

Stauffer, G. Estimate of the spawning biomass of the northern anchovy central subpopulation for the 1979-80 fishing season. Adm. Rep. No. LJ-79-22.

HONOLULU LABORATORY

RESOURCE ASSESSMENT AND DEVELOPMENT INVESTIGATIONS (RADI)

Northwest Hawaiian Islands Resource Survey Cruise Completed

The Townsend Cromwell returned to Honolulu on June 6, completing another cruise (TC-79-02) surveying the fishery and other biological resources of the Northwestern Hawaiian Islands (NWHI). The cruise was divided into two parts: Part I was a survey to assess the primary and secondary productivity of NWHI waters, conducted by personnel of University of Hawaii Sea Grant; and Part II was a survey of offshore and nearshore wildlife marine resources, conducted by the staff of the SWFC Honolulu Laboratory, the Hawaii Department of Fish and Game, and the U.S. Fish and Wildlife Service. Robert L. Humphreys, Jr., Research Assistant, was Chief Scientist on Part I, and Fishery Biologist James H. Uchiyama served as Chief Scientist on Part II.

During the second part, researchers measured the incidence of ghost fishing by lost lobster traps, which is one of the problems discussed in the draft spiny lobster fisheries management plan of the Western Paific Regional Fishery Management Council. Experiments were also conducted to determine the optimal size of lobster trap escape vents. The latter experiments showed that undersized spiny lobsters, Panulirus marginatus, could exit through the vents, however, some sublegal lobsters also remained in the traps.

Research Assistant Linda M. Paul will conduct further experiments on escape vents and the effectiveness of California lobster pots with the 300 live lobsters brought back on the Cromwell.

Other work completed on the cruise included a survey of seamount resources, a survey of spiny losters and demersal fishes in previously unsampled areas of the Northwestern Hawaiian Islands, gear competition tests, experiments to determine predation on spiny lobsters released at the surface, and the collection of biological data and samples for ongoing projects.

Study Suggests that Lobsters Released From Boats are Not Subject to Predation

Undersized and egg-laden lobsters, which must be returned to the water by commercial fishermen, do not appear to be subject to predation when released on the surface from boatside, according to researchers who were aboard the R/V Townsend Cromwell during its latest voyage. Biologists Reginald Gooding of the Honolulu Laboratory, John Naughton from the Western Pacific Program Office, and Research Assistant Alan Everson performed the study, which involved releasing lobsters while their natural predators were in the vicinity. The study was done to help determine whether regulations need to be written into the Fisheries Management Plan for the NWHI fishery, specifying how sublegal lobsters should be returned to the bottom.

Spiny and slipper lobsters were released at the surface, and spiny lobsters were freed on the bottom from a release bag, in the presence of several potential lobster predators: Galapagos shark, Carcharhinus galapagensis; gray reef shark, C. menisorrah; omilu, C. melampygus; and ulua, Carangoides ferdau. Eight observational dives were made. Although the experimental procedure went well and dozens of spiny and slipper lobsters were released near potential predators, none was attacked.

The work took place at Necker and Nihoa Islands. Further experimets in the presence of large schools of frenzy-feeding carangids must be conducted to complete the primary study.

Research Cruises to the Northwestern Hawaiian Islands Continue

The Townsend Cromwell departed on June 18 on its third cruise of 1979 (TC-79-03). Led by Fletcher V. Riggs, the scientific crew will continue to conduct productivity studies and marine resources surveys in waters of the Northwestern Hawaiian Islands. Research Assistant Victor A. Honda from the SWFC Honolulu Laboratory is also participating in the cruise.

Research Assistants Robert Humphreys, Bert Kikkawa, and Linda Hubbell built scientific gear for the cruise and loaded it on the Cromwell.

Fish Sampling for Ciguatera Studies Continues

Richard N. Uchida, Leader, Insular Resources Task, reported that Research Assistants Bernard M. Ito and Paul M. Shiota continued to collect tissue samples from amberjack, Seriola dumerilii, landed at the United Fishing Agency in Honolulu. The samples are being analyzed for the presence of ciguatoxin by Research Assistant Brian S. Joyo under the supervision of Dr. Yoshitsugi Hokama, Pathology Department, John A. Burns School of Medicine, University of Hawaii. Ciguatoxin is a potent poision found in numerous fishes that is unidentified and unpredictable.

The ciguatera study has generated considerable interest among Federal and State agencies and the local fishing industry. Briefings on the Honolulu Laboratory sampling program were presented at two meetings held during the month. Attending one meeting were Richard S. Shomura, Director, Honolulu Laboratory, Uchida and Ito, Dr. Hokama, and Thomas Billy, James Brooks, and Glenn Kiel of the Seafood Quality and Inspection Division, NMFS. The other meeting was convened by Dr. Ned Wiebenga, Hawaii State Department of Health and was attended by representatives of several State agencies including Hawaii Department of Fish and Game, Office of the Marine Affairs Coordinator, the Department of Planning and Economic Development, UH School of Medicine and Department of Zoology, and the local fishing industry.

Preliminary Findings Suggest Overfishing of Spiny Lobster

A statistical analysis of lobster yields at Necker Island shows that 65,676 legally allowable spiny lobsters--those at least 8.25 cm long--were caught in 1977, substantially exceeding the maximum sustainable yield

estimated to be from 14,000 to 21,000 lobsters per year. Statistician Dr. Jeffrey J. Polovina and Research Assistant Darryl T. Tagami have included these preliminary findings in the first draft of their manuscript, "Analysis of catch and effort data for the spiny lobster, Panulirus marginatus, at Necker Island." The paper summarizes data of commercial and research fishing at Necker Island from November 1976 through May 1979. The authors note that since this analysis is based on a short-term exploitation of a previously unfished resource, long-term population trends may differ substantially from these early results.

Many Squid Beaks Found in Albatross Spew

Thomas S. Hida, Fishery Biologist, continued his examination of material regurgitated by seabirds. The spew of black-footed albatross, Diomedea nigripes, and Laysan albatross, D. immutabilis, contained large amounts of squid beaks and masses of fish eggs, probably those of flyingfish. Most of the squids belong to the family Ommastrephidae, according to Dr. Richard Young, Department of Oceanography, University of Hawaii. Young further identified some of the squids as belonging to two genera, Ommastrephes and Symplectoteuthis, and identified a few down to species: S. oualaniensis and Hyaloteuthis pelagica.

Manuscript Revised

Reg Gooding revised the manuscript, "Respiration rates and low-oxygen tolerance in skipjack tuna, Katsuwonus pelamis," following favorable reviews by Dr. J.R. Brett, Fisheries Research Board of Canada, and Dr. E. D. Stevens, University of Guelph. After final comments from co-author Dr. William Neill of Texas A&M University, the manuscript will be submitted for Center approval.

Groundwork for Possible Monk Seal Research Started

Reg Gooding, Fishery Biologist, began gathering background information for a draft research application under provisions of the Marine Mammal Protection Act and the Endangered Species Act for research to be conducted on monk seals, an endangered species, by the Honolulu Laboratory. Gooding also continued work on a report on the monk seal aerial surveys that he and Bernard Ito, Physical Science Technician, made in the Northwestern Hawaiian Islands.

Hawaii Skipjack Tuna Catch Continues Below Long-Term Average

The June 1979 Hawaii landings of skipjack tuna is estimated to be 448 metric tons (MT), which is 22 MT above the June 1978 landings but 288 MT below the 1948-78 long-term average for June. The cumulative landings from Janaury through June is estimated at 1,553 MT, which is 131 MT below the 1978 landings for the same period and 272 MT below the 1948-78 long-term average for the same period.

FISH-ENVIRONMENT INVESTIGATIONS (FEI)

Yellowfin Tuna Temperature Preference Experiments Suspended

Dr. Andrew E. Dizon, Leader, Experimental Ecology of Tunas, reported that experiments on temperature preference of yellowfin tuna have been suspended for the balance of FY 79 due to excessive costs of electric power and for replacement of saltwater heaters. Operating costs for electrical power average about $75 per experimental day and each test subject should ideally be allowed one week in the tank system. Power costs have risen substantially faster than had been anticipated. In addition, the twelve 7.5-kW heaters, constructed of #304 stainless steel which are being used to maintain temperatures, were never intended for saltwater use. Dizon hoped that corrosion would be slow enough so that at least five fish could be tested before the heaters failed. However, after two subjects were tested, several heaters showed evidence of serious pit corrosion. Dizon decided to stop the experiments before the heaters were destroyed. Work will continue when funding is available for corrosion-resistant materials, to cost $2,500, and when there is funding to meet the higher power costs. The monies are budgeted for FY 80.

Kawakawa Spawns in Shoreside Tanks, Gonadal Studies Continue

Captive kawakawa, Euthynnus affinis, were induced to spawn in shoreside tanks at the Kewalo Research Facility, according to Dr. Calvin Kaya, visiting scientist from Montana State University. Kaya believes that this is the first instance of induced spawning of captive tuna.

Gonadal biopsies continued at the laboratory, and for the first time gonadal regression was observed. Although the females in tank D continued to develop, those in tank E, including the two most advanced females, showed signs of regression (Table 1). The occurrence may have been related to stresses suffered by the fish during a power failure during the preceding week.

Table 1. Tuna ova diameters (mm).

	Date	N	Range	Median	Mean
Tank D	6/12	6	0.23-0.41	0.27	0.30
	5/15	6	0.19-0.29	0.26	0.25
	4/17	5	0.14-0.30	0.21	0.22
	3/13	4	0.09-0.12	0.11	0.11
Tank E	6/19	13	0.11-0.31	0.19	0.19
	5/15	12	0.11-0.53	0.22	0.24
	4/18	12	0.12-0.43	0.18	0.21
	3/20	12	0.10-0.24	0.13	0.14

The biopsies on June 19 revealed that two female tuna brought by the Townsend Cromwell on June 6 had ova averaging 0.53-0.55 mm in diameter, and were probably too immature to be induced to spawn. Additionally, they were developing puffy snout and so were expected to undergo rapid physical deterioration. Therefore, the researchers decided to test the fishs' responses to injected hormones before further damage occurred. Two males from tank E, which had been in captivity since February 14 and had earlier yielded milt in biopsies, were also used in the trials. Combinations of salmon pituitary (SP), human chorionic gonadotropin (HCG), and pregnant mare serum (PMS) were administered at two dosages to the males and females, in two series of injections 24 h apart (Table 2):

Table 2. Injections

June 19			June 20			
Specimen	SP (mg)	HCG (IU)	Specimen	SP (mg)	HCG (IU)	PMS (IU)
Female #5	5	100	Female #5	5	100	1,000
Female #6	10	500	Female #6	10	500	2,000
Male F		100	Male F		100	
Male L		500	Male L		500	

Biopsies taken 24 h after the first injections did not reveal significant change in ova diameters. However, ova were found in the strainer about 43 h after the start of the treatments, and from the number present in the strainer, it appeared that ovulation had occurred some hours previously. Biopsies indicated that only the female receiving the higher dose had ovulated and milt could be stripped from only the higher dosage male. Eggs and sperm were taken from this pair to effect fertilization. The ovaries and testes were then dissected out and a few more ova were thus obtained and fertilized. The eggs were placed in an aquarium after being allowed to stand for about 10 min. Most of the eggs sank to the bottom of the aquarium, leaving only a few floating and still potentially viable. However, most of the latter had also sunk by the next morning, and development beyond early cleavage stages was not seen in any of those sampled. Thus, although the ova found in the strainer and those obtained directly from the female were normal in size and appearance (1.0-1.1 mm diameter, clear and transparent, containing large oil globules about 0.25 mm diameter), no advanced embryos resulted. It appears that ova of this species may rapidly lose their viability after ovaulation.

About 37,000 ova were collected by the strainer, as gauged by volumetric measurement and subsample count. The ova taken directly from the female were inadvertently discarded before they could be counted, but probably numbered under 10,000.

Attempts were made to continue the experiment by administering higher doses to the two remaining fish. However, the female died the next day from handling stress so the experiment ended.

Shakedown Cruises Made on New Boat, Kaahele'Ale

Two shakedown cruises were made in the new small research boat, Kaahele'Ale by Fishery Methods and Equipment Specialist Donald Aasted, Research Assistant Thomas Kazama, and Lt.(jg) Howard Jemison. Buoy "A" was visited on the first trip, which was planned to investigate possible survey methods, test gear, and change warning light batteries on the buoy. Depth sounder transects with the 50 kHz Ross instrument revealed a high density of echoes beneath the buoy, but almost none outside a radius of 100 m. Echoes ranged from the surface to about 35 m in depth. Most of the images were believed to be that of small yellowfin, bigeye, and skipjack tunas. Yellowfin and bigeye tunas were caught on trolling lines near the buoy. Approximately 300 birds were observed feeding in the vicinity.

The second cruise was made to examine the differences between the 50 kHz echo sounder and a 100 kHz model provided by Ross Laboratories. A representative from the firm was present during the tests. There seemed to be no difference in the quality of the records.

Lt.(jg) Jemison and Messrs. Aasted and Kazama also installed a radar unit on the Kaahele'Ale. This gear, purchased many years ago for another boat, is useful in establishing vessel position for ultrasonic tracking experiments. Even after the long storage period, the radar worked well.

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Honolulu Laboratory is cooperating with the Coastal Fisheries Resource Division at La Jolla by providing sonic tracking equipment for the upcoming six-day albacore tracking study. Lt.(jg) Jemison and Dr. Dizon will accompany the La Jolla researchers on the baitboat Linda, on charter to the American Fishermen's Research Foundation. During the tracking period, the RV David Starr Jordan will conduct an oceanographic and biological survey of the areas surrounding the Linda. Lt.(jg) Jemison made eight depth-sensitive tags for the study; he estimates that material costs for each tag is $102. The tags are 5/8" by 1-1/2" by 4", have a two-day life, and produce a 160 MW output signal at 32 kHz.

LA JOLLA LABORATORY

Coastal Fisheries Resources Division

ALBACORE FISHERIES

Age Determination Method Found for North Pacific Albacore

North Pacific albacore appear to have visible daily growth rings on their otoliths, enabling exact age determination, according to the preliminary results of an experiment by Southwest Fisheries Center Oceanographer R.M. Laurs and Fisheries Biologist R.N. Nishimoto. The findings are contained in an Administrative Report and were presented at the North Pacific Albacore Workshop in Shimizu, Japan by Dr. Laurs.

Although there have been numerous age determination studies conducted on albacore, there is disagreement in the findings made by investigators. Absolute age and growth rate determination remain important unsettled questions in albacore biology. The otolith daily ring increment method for aging fishes appears to be a powerful tool holding great potential for solving problems regarding age determination in albacore. The daily ring increment method of aging fishes assumes that there is a daily ring deposition on the otolith. The Southwest Fisheires Center's albacore group is conducting an experiment to determine if this assumption is valid for albacore.

Albacore were tagged and injected with tetracycline, an osteophytic agent, which is incorporated into bone and fluoresces when viewed under ultraviolet light. The otoliths of the tagged fish are thus "marked" at the time of release. For recaptured fish, information on the time at liberty can be used to determine the rate of ring formation. The assumption of daily ring deposition may then be tested.

Microscopic examination was conducted by Nishimoto and T. Foreman and A. Wild of the Inter-American Tropical Tuna Commission using methods employed by Tuna Commission scientists for similar studies on yellowfin and skipjack tunas.

More than 2,500 albacore were injected, tagged, and released during the field operations of the tetracycline/otolith daily ring study. Of these, 84 have been recovered. However, in some cases the otoliths or information on time at liberty were not available, so there were not sufficient data from all the recoveries to use in the analysis of the results. The researchers examined otoliths from 67 albacore injected with tetracycline. Otoliths from six of these fish did not show any tetracycline "mark." This was found to have resulted from a defective tetracycline solution, which was used to inject a small number of fish at the start of the experiment; and apparently from improper injection technique where the hypodermic needle was withdrawn too quickly and the tetracycline solution leaked out. Tetracycline "marks" were apparent on otoliths from 61 fish. Under ultraviolet illumination, the appearance of the "marks" ranged from bright and clearly visible, to faint and

sometimes difficult to see. However, in all 61 cases it was possible to locate the "mark" and make the ring counts.

The relationship between otolith rings laid down after tetracycline injection at time of release and days at liberty before recapture was found to be $y=0.986t$, where y equals number of rings and t equals number of days.

In order to evaluate the relationship between otolith ring increments and days at liberty, it is necessary to adjust the otolith ring increments for the lag that may occur between the time of tetracycline injection and the appearance of the "mark" on the otolith. It appears that this lag is less than 1 day. A more rigorous investigation of the lag in time between injection and the appearance of the "mark" on the otolith is under way.

The results obtained thus far show that for tetraycline-injected albacore the relationship between otolith ring increments and days at liberty is nearly 1:1. This finding indicates that albacore have detectable daily growth rings on their otoliths, at least over the size range that the fish were injected, and that the otolith daily ring aging method may be used successfully with North Pacific albacore. The researchers expect that approximately 15 or more albacore released during 1977 and 1978 will be recovered during the 1979 fishing season. Data from fish that have been at liberty for one year or longer should provide a more conclusive evaluation of the otolith growth ring aging method.

North Pacific Albacore Tagging Study Described

Dr. Laurs also prepared and presented a report at Shimizu on the stock structure of North Pacific albacore as indicated by tagging studies.

The National Marine Fisheries Service and the American Fishermen's Research Foundation began conducting a cooperative North Pacific albacore tagging program in 1971. The purpose of the joint tagging study is to examine the migration patterns and stock structure of North Pacific albacore and to obtain information for use in population studies. Nearly 15,000 fish have been tagged and released since the start of the study. Most of the tagging has taken place in waters inshore of 130° W and south of 37° N, and to a lesser extent, in waters offshore of 130° W between 32°-41° N and in inshore waters north of 38° N.

Results from the tagging studies suggest that there are at least two substocks of fish that compose the North Pacific population of albacore and that these substocks have different migratory patterns. A northern substock of fish makes trans-Pacific migrations between the eastern and western North Pacific resulting in an exchange of fish between the northern area (north of about 40° N) of the U.S. fishery and the Japanese livebait fishery, and the longline fishery west of 180°. A southern group of fish have a different migration scheme from the northern group and appear to enter the U.S. fishery south of about 40° N and the longline fishery east of 180°. Only a very small proportion of the southern group of fish appear to migrate between the eastern and western Pacific and enter the Japanese pole-and-line fishery. During a given season there is very little exchange of tunas in the U.S. fishery between the northern and southern substocks.

Geographic differences in size composition of albacore taken in the U.S. fishery, and geographic differences in calculated growth rates for tagged fish, support the hypothesis that the North Pacific albacore population consists of at least two substocks.

Albacore to Arrive Late this Year

The main groups of albacore will arrive late in the waters along most of the Pacific west coast this year, according to the 1979 annual forecast of the Albacore Fisheries Investigations Group, Southwest Fisheries Center. For the "southern" group, the delay is believed to be caused by a extended westerly migration last winter, leading the fish further offshore then they have gone in past few years. Most of the "northern" group is expected to enter the U.S. fishery off the Pacific Northwest after mid-August.

The "northern" and "southern" groups are believed to be separate, each following its own migratory pattern. Before their migration through the North Pacific, the "northern" group is fished by the Japanese, who reported the fishs' late arrival there this year.

About sixty percent of the commercial albacore fishery is forecast to be south of San Francisco this year, as judged by the expected time of migration, oceanographic conditions, and seasonal development of the fishery.

LARVAL FISHES, COASTAL EAST PACIFIC

Manuscript on Morphometric Analysis of Larval Fish Revised

Fishery Biologist Gail Theilacker revised her manuscript, "Effect of feeding history and egg size on the morphology of jack mackerel, Trachurus symmetricus, larvae," scheduled for publication in Vol. II of Early Life History of Fish. In this paper, Theilacker develops a morphometric analysis that can be used to predict the nutritional condition of individual jack mackerel larvae. Criteria used in the analysis were based on measurements of larvae raised in controlled environments in which availability of food and time of feeding (delayed by one or two days) were varied.

The growth rate of larval body parts differed for each treatment. Theilacker checked the precision of morphometric estimates of larval condition by examining the same larvae using histological criteria that identify larval condition. For larvae raised in independent experiments, in which the type of food (wild versus laboratory-cultured) and density of food were varied, histological examination revealed that 88 percent of the larvae had the same condition classification that was estimated by using morphometric criteria. The morphometric analysis, therefore, should allow reasonable estimates of jack mackerel larva condition independent of egg size and feeding history. Ultimately, morphometric criteria may be useful for estimating larval survival in the field.

The histological examination of the larva also showed that tissue degeneration caused by one day of starvation after yolk absorption completely regenerated in 89% of the larvae after feeding for two days, and that tissues never completely regenerated in feeding larvae following two days of starvation after yolk absorption.

New Plankton Microstructure Sample Tested

Dr. Robert Owen and Lee Inness-Brown finished construction and preliminary testing of a new plankton microstructure sampler. The sampler simultaneously captures whole water samples, filters with small opening/closing nets over metered horizontal distances, and measures temperature microstructure. The instrument can be used at any depth.

The instrument was deployed in June from the research vessel, Jordan, in the Southern California Bight to determine small-scale variations in concentration of small zooplankton and phytoplankton suitable as food for larval fishes, and to explore possible modes of patch growth and decay in the upper ocean. Of the eleven successful costs, three provided good measurements of thermal microstructure. Together with salinity determinations from the whole water samples obtained at the same time, these data will yield estimates of density microstructure to assess whether passive collections of particles at or between small-scale density gradients is an important mode of microstructure formation.

The remaining casts will be useful, among other purposes, for determining whether the Free-Fall Particle Counter (FFPC) built at SWFC by Dr. R. Lasker and J. Brown can be used for systematic surveys of particle microstructure over large ocean areas. The FFPC was placed just below the microsampler to detect variations in particle concentration sampled directly by the microsampler.

Immature Anchovy and Hake Populations Surveyed

A survey of the distribution of larval and juvenile anchovy and hake was conducted during June 1979 on the NOAA research vessel, David Starr Jordan. Two collectors were used: a 6-foot Isaacs-Kidd midwater trawl and a 40-foot hake trawl. Samples were collected from San Diego to Pt. Dume, as far as 150 miles offshore. Analysis of these samples is incomplete but several observations were made. No juvenile anchovy were collected although adult anchovy occurred in 10 of 26 hake trawl samples. Anchovy larvae up to about 30 mm occurred in all 72 of the IKMT samples. The juveniles could have been close to shore and so not in the path of the sampling gear. This possibility will be investigated on the August and September cruises. The abundance of anchovy larvae corresponds to the heavier-than-normal spawning in May (Stauffer, pers. comm.). Late larval and juvenile hake were taken in 7 of the 26 hake trawl samples and in 46 of the 72 IKMT samples. The hake were distributed closer to the surface than expected, many of the tows containing larvae sampled only the upper 20 meters of the column.

Future work on these samples will include quantitative analysis of anchovy and hake abundance, size frequency distribution of anchovy and hake,

classification of the other fish larvae, determination of birthdates, and growth rates of larvae in some of the samples.

Photorepair in Anchovy Larvae Observed

Dr. John Hunter reports that work was completed this quarter on photorepair of UV damage (photoreactivation) in anchovy larvae. To determine if photoreactivation exists in anchovy larvae, larvae were given a daily 6-hour UV-B exposure during either the first 6 or the last 6 h of the 12 h laboratory day. Throughout the day, larvae were exposed to longer wavelength energy provided by Chroma 50 fluorescent lamps. The experiment was conducted for 4-days and the results were compared to a previous 4 day experiment (Hunter et al., 1979) in which a 6 h UV-B exposure was centered in the 12 h day.

Survival in this 4-day experiment clearly demonstrated the existence of photorepair in anchovy larvae. Survival at the same dosage was lower when exposure occurred at the end of the day than when it occurred during the first 6 h of the day. Survival in the group exposed to UV-B during the first 6 h was about the same as that reported in Hunter's previous work where exposure occurred in the middle of the day. Thus, an exposure of 3-6 hours of photoreactive radiation following UV-B exposure appears to be adequate for repair. Growth was retarded in all surviving larvae, but larvae exposed during the first 6 hours were significantly larger at all dosgaes than those exposed during the last 6 hours of the day.

To evaluate photorepair mechanisms over a longer period, Hunter exposed larvae to UV-B during the last 6 hours of the 12-hour day for 12 days and compared the results to past work where the exposure period was centered in the 12-hour day. In contrast to the results from the 4-day experiment, no difference existed in survival between larvae exposed in the middle of the day and those exposed at the end of the day. Thus, survival of larvae given no photoreactive energy following the UV-B exposure did not differ from those given 3 hours of photoreactive energy after exposure. The most tenable explanation for the difference between the 4- and 12-day experiments is that at the low dosages used in the 12-day experiment the rate of photorepair kept up with the rate of repairable damage. Consequently, additional photoreactive energy occurring at the end of the daily UV-B exposure did not increase survival.

If photorepair rates keep up with photorepairable damage at the low dosage rates used in the 12-day experiments, an explantion is needed for the mortality that occurs at these rates. Along with other mechanisms of damage done by UV-B, mortality could simply be related to the metabolic cost of repair (photoreactive and non-photoreactive). A common characteristic of all Hunter's work is that growth was always retarded even at the lowest dosages used in the experiment. At the weak exposures used in the 12-day experiments, little histological evidence existed for UV-induced tissue damage, but evidence did exist for early stages of starvation in some of the UV-exposed larvae. None was found in the controls. Larvae that have to devote a significant proportion of their energy to repair may not have sufficient reserves to support the energy costs required for finding and capturing live prey. Hence larvae could gradually starve to death because of the added

energy burden of repair. Any event that affects energy costs is likely to affect survival in larval anchovy.

COMMERCIAL AND RECREATIONAL FISHERIES RESEARCH FOR MANAGEMENT

Economic Study Conducted of the "Market Fish" Fishery and Fleet in San Diego

Jane McMillan is supervising a Sea Grant intern from UC, Santa Cruz, Dennis Fitzpatrick, who is working on an economic analysis of the San Diego market fish fisheries. While the tropical tuna industry is by far the most important fishery in San Diego, over two dozen other species with a total exvessel value of $2.5 million were landed in San Diego in 1977. This project will analyze the market flows of these fish from boat to consumer by examining the harvesting sectors, processing sectors, and marketing sectors. Of special interest will be the local restaurant demand for fish in San Diego. A final report will be completed in September.

Fitzpatrick is studying economics and environmental studies at Santa Cruz.

Aerial Spotter Data Program

Joe Caruso completed verification of the 1978 Aerial Marine Resources Monitoring System (AMRMS) data. Hardware problems on the Burroughs computer caused the sighting data to be destroyed after verification. Although the files were eventually remade, at least five work days were lost.

Plots of spotter aircraft reported excellent anchovy fishing during the last part of April and the entire month of May. An estimated 45,000 tons of anchovy were caught in 40 days. Pacific mackerel schools also seem to be abundant, especially around San Clemente Island.

Rockfish Surveyed on Recent Cruise

Fishery Biologist John MacGregor reports that a short cruise was made in late May and early June to collect rockfish. The areas of collection were San Clemente Island, Cortez Bank, Santa Barbara Island and San Nicolas Island. A few samples were taken later in June on other legs of the cruise.

The samples have not all been processed yet. To date, 15 species of rockfishes have been identified: ten were found at San Nicolas Island, eight at Cortez Bank, and six each at San Clemente Island and Santa Barbara Island.

Blue rockfish were most abundant at all four stations, and at San Nicolas Island outnumbered all other rockfishes combined. Olive rockfish, taken in all four areas as well were also abundant, and to a lesser extent so were bocaccio and whitebelly, rosy, starry, and vermilion rockfishes. Less frequently taken species were treefish and squarespot, honeycomb, speckled, yellowtail, gopher, greenstriped and greenspotted rockfishes.

Study of Fishing Vessel Construction in U.S. Under Way

Jane McMillan is taking part in an NMFS study of boat building in the United States. The study responds to a request by the House Merchant Marine Committee for an assessment of the impact of the Fishery Conservation and Management Act (FCMA) of 1976. A telephone questionnaire is being designed to survey boat-building firms throughout the U.S. McMillan, an Industry Economist, recently traveled to New Orleans with Economist Mort Miller of NMFS Washington, to confer with editors of Fish Boat magazine, which annually collects data on fishing vessel construction. Initial indications are that fishing vessel construction is booming in the U.S. Many boats are being constructed for the Alaska king crab fishery, the west coast black cod fishery, the Gulf shrimp fishery, and the east coast trawl and scallop fisheries. The study will examine whether the current boom in boat building is strictly seasonal, if it is a result of the FMCA, of NMFS financing assistance, or if other factors are responsible.

U.S.-Soviet Bilateral Meeting Held in Seattle

Fishery Biologist Dr. Gary Stauffer attended the U.S.-U.S.S.R. bilateral meeting on fisheries assessment in the North Pacific, held at the Northwest and Alaska Fisheries Center (NWAFC) Seattle, Washington in early June. The status and number of fish stocks were discussed, including those of Pacific hake, jack mackerel and northern anchovy. Stauffer presented a memo report on the hake spawning biomass, based on the 1979 CalCOFI survey. He concluded that current magnitude of the hake stock between the U.S.-Mexican border and San Francisco is at least as large as the 1977 and 1978 levels, and that the spawning is distributed in the waters between the U.S.-Mexican border and San Francisco, and possibly further north.

The Soviets presented two papers on the biology and status of the jack mackerel population. The most signficant information is that they have found commercial concentrations of large jack mackerel 400-700 miles offshore of California during the spawning season. They also put forth a two-species hypothesis for the jack mackerel population, in response to a question that was raised by Stauffer at the previous bilateral meeting.

The Soviets and Americans agreed to conduct a 8-10 week research cruise in 1980, which will include 6 weeks of ichthyoplankton surveying and a 2- to 4-week survey of the jack mackerel population. Details of research will be worked out during the coming months.

Increase in Anchovy Population Forecast for 1979

Gary Stauffer, with the assistance of Computer Programmers Butch Burris and Rich Charter, estimated the 1979 spawning biomass for the central subpopulation of northern anchovies at 1,723,000 short tons, a 32% increase over 1978 estimate. Based on the Pacific Fisheries Management Council Anchovy

Fishery Management Plan, optimum yield for the central subpopulation during the 1979-80 fishing season is 241,000 short tons. The optimum yield in the U.S. Fishery Conservation Zone is 168,700 short tons. The U.S. reduction quota is 156,000 tons, to be divided between the northern and southern permit areas.

Evidence of anchovy spawning north of Pt. Conception off central California was found only during January. To the south, anchovy larvae were consistently taken on all four cruises as far out as 140 n. mi., approximately 40 n. mi. further than in 1978. The percent of larvae south of the U.S.-Mexican border was 53.5% in 1979, compared to the long-term average of 30%. Spawning took place from January through May off southern California and Baja California. The number of anchovy larvae sampled in May off Baja California was the highest ever recorded.

The estimation procedure for 1979 was compliated by the fact that the regions off Baja California were only surveyed in the second half of the winter and spring quarters. Regression equations were therefore developed to estimate larval abundance for the Baja regions from the observed larval abundance figures for the other areas. The estimate for annual anchovy abundance is 17.58 trillion larvae, a figure that includes adjusted estimates for south of the border and an expansion of the winter and spring abundance to an annual figure.

The 1978 anchovy class is estimated at 1.0 to 1.2 million tons, as gauged by age composition data from the Spring U.S. commercial fishery and the acoustic trawl survey conducted in February by the California Department of Fish and Game. One million tons is considered to be of moderate recruitment strength. The large spring spawing is attributed to the late maturity of the 1978 class.

MULTISPECIES TAXONOMY

Sampling Done for Multispecies Taxonomy Program

As part of an ongoing study of comparative feeding behavior of fish larvae, the staff of the Multispecies Taxonomy Program with Barbara MacCall as Cruise Leader participated in the daytime segments of Jordan cruise 79-06 to obtain stratified samples of fish larvae and microzooplankton. A pump, lent by Dr. M. Mullin of SIO and operated by Kim Devonald, also of SIO, was used to take vertically stratified samples of about 95 liters of water. Microzooplankton were collected in a 20 micron sock. After sampling by pump, the researchers made net tows at the same depths with a manta net, an opening/closing bongo net (on loan from SIO), and a CalCOFI bongo net.

The depths sampled with the pump and net tows were: 1) the surface; 2) the mixed layer at 10-15 m; 3) the chlorophyll maximum layer or approximately 30 m if no chl. max. was found; and 4) area below the chl. max. layer, 40-45 m, which was the depth limit of the hose on the pump. The chl. max. was determined by using Dr. Lasker's pump and a fluorometer; samples were taken for chlorophyll and Coulter Counter analyses. Though the opening/closing

bongo net was initially deployed for discrete horizontal net samples, the closing mechanism neer worked reliably, so the CalCOFI bongo net was substituted. As a result, unavoidable contamination ensued while the net was moved to and from sampling depth. In addition, a series of non-quantitative plankton tows were made near the surface for Bouin's preservation, to provide samples for Gail Theilaker and Dr. C. O'Connell's histological studies.

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Dr. Lasker Attends Korea-U.S. Marine Biology Meeting

During the last week of June, Dr. Reuben Lasker participated in a joint Republic of Korea-United States meeting on Marine Biology sponsored by the National Science Foundations of both countries. The purpose of the meeting was to explore areas in marine biology and fisheries in which fruitful collaborative studies could be done. The meeting was held at the Korean Institute for Science and Technology in Seoul and was attended by six U.S. delegates and six Korean delegates, chiefly from the National University for Fisheries in Pusan. Principal subjects for discussion were future power plant sitings and their effects on inshore Korean waters; aquaculture, chiefly of seaweeds and oysters; and development of inshore fisheries around Korea. Dr. Lasker illustrated the management scheme now being used in the United States for the 200-mile Fishery Conservation Zone, and discussed research under way at the Southwest Fisheries Center for the development of new management plans and for continual biomass assessment of those species under management.

Korean and Japanese waters have been notable in recent years for explosive production of species that had previously collapsed as a fishery (as occurred with the Japanese sardine), or had newly appeared as did the file fish, Navodon modestus, which is currently being fished by the mainland Chinese and the Koreans at yields of over 200,000 tons per year. Areas for fishery research identified as being mutually suitable for study and important to both countries were: 1) the definition of subpopulations; 2) improved data management, processing and retrieval; and 3) improved biomass assessment. The U.S. delegation continued to Pusan where Dr. Lasker gave a talk at the National University of Fisheries on his current research.

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Development of Fish Bookeeping System, MIDAS, Under Way

Cynthia Haight, Geoff Moser, Rich Charter, and Paul Smith have completed development of the first phase of a computerized data handling system, MIDAS (Multispecies Identifier Data System) which embodies five functions: 1) contains a file of fish names and their identification codes; 2) allows data to be entered by hand for punching as formatted cards; 3) provides programs for plotting larval fish distribution and abundance; 4) provides programs for listing stations at which a given species of fish is found; and 5) lists species found at a station on one or more cruises. The selection of a "short" list of species was based on the taxons identified from data collected during the 1975 CalCOFI cruise year.

One interesting result is the apparent stability of the numerically abundant non-commercial fish species. Of the top ten fish species in 1975, eight were among the top ten in abundance during the 4 years, 1955 through 1958. Rankings by species are shown in the accompanying table.

1975 Rank	Name	N	1955 Rank	1956 Rank	1957 Rank	1958 Rank
1	Leuroglossus stilbius	23,926	1	1	2	6
2	Triphoturus mexicanus	20,081	2	3	4	2
3	Stenobrachius leucopsarus	13,759	4	2	3	3
4	Vinciguerria lucetia	12,963	3	4	1	1
5	Bathylagus ochotensis	7,227	5	7	9	8
6	Protomyctophum crockeri	4,719	10	15	17	11
7	Tarletonbeania crenularis	4,593	9	5	8	not ranked
8	Diogenichthys laternatus	4,362	6	6	5	4
9	Bathylagus wesethi	3,834	7	8	6	5
10	Lampanyctus ritteri	2,279	8	9	7	7

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Draft 5-Year Plan Prepared for Fisheries-Related Socioeconomic Data Collection

Southwest Fisheries Center and Southwest Region economists D. Huppert, E. Ueber, W. Silverthorne, and M. Adams prepared a draft 5-year plan determining what data are needed to satisfy the requirements of the Fishery Conservation and Management Act, the National Environmental Policy Act, and Executive Order 12044. Hoyt Wheeland from the Office of Science and Environment requested the report, which was prepared during a 2-day meeting at the Tiburon Laboratory. The plan also addresses other projects, including cost/benefit evaluations of fishery develoment. Specifically, the report contains descriptions of the types of data sought, their desired collection frequency, current availability and method of collection, and estimated annual collection costs. The group determined that information for the following categories is needed:

1. Prices - exvessel, wholesale and retail
2. Product quantities by state for form
3. Fishing costs and earnings
4. Recreational catch and expenditures
5. Commercial vessel inventory
6. Processor costs, product yields
7. Recreational vessel inventory
8. Imports, exports and Hawaii-continent trade.

The Southwest Regional plan will be combined or coordinated with the Northwest Plan, and is to be included in a national plan for presentation to Assistant Administrator for Fisheries, Terry Leitzell.

Oceanic Fisheries Resources Division

TUNA RESOURCES PROGRAM

Scientists Prepare Papers for Albacore Workshop in Japan

Members of the Tuna Resources Program prepared two papers for presentation at the Albacore Assessment Workshop to be held in Shimizu, Japan in late June. The first, entitled "United States Consumption and Production of Albacore (Thunnus alalunga)", authored by Norman Bartoo, Fishery Biologist, Noelle Beerman, Economist, and Gary Sakagawa, Chief of the Oceanic Fisheries Resources Division. This report focuses on the U.S. market for albacore and describes consumption rates, demand, exvessel prices, supply and market trends. Currently, U.S. fishermen supply approximately 20% of the total U.S. consumption. Imports from more than 40 nations provide the balance.

The second paper, "Status of the North Pacific Albacore Stock from the Yield-Per-Recruit and Recruitment Standpoints," was written by Fishery Biologists Norman Bartoo and Earl Weber. Analytical procedures were used to assess the status of albacore in the north Pacific. The analyses show that a shift in fishing operations by the Japanese surface fleet has resulted in increased instantaneous fishing mortality of younger albacore. The shift has also caused increased yield-per-recruit for the Japanese surface fleet, although not enough to offset decreases in yield-per-recruit for the Japanese longline and U.S. jig fleets, the other two principal fisheries. The paper also presents evidence of a decrease in spawners in recent years, but there are presently insufficient data to determine the effect on recruitment.

Billfish, Shark Management Plan Assembled

Progress was made on the first integrated draft of the Pacific Billfish and Oceanic Shark Fishery Management Plan, according to J. Squire, Chairman of the Plan Development Team. On June 5-8 a meeting was held to integrate working draft plans developed for the U.S. west coast billfish and shark fisheries with those for the central and western Pacific billfish and shark. Attending the meeting were Squire; Richard Shomura, Chairman of the Western Pacific Council Plan Development Team; and Heeny Yuen, Fishery Biologist at the Honolulu Fisheries Laboratory.

The final management plan will be in three parts: Part I will be a review of the development of the oceanic fisheries throughout the Pacific for billfish and oceanic sharks, and the general biology, life history, stock distribution, and stock assessment estimates for the six species of billfish; Part II will be a review of the central and western Pacific sport and commercial fisheries within the U.S. Fishery Conservation Zone and present management options; and Part III will consist of a review of the U.S. west coast sport and commercial fisheries and present management options.

The first working draft of the integrated Billfish and Oceanic Shark FMP is scheduled for presentation in late August at a joint Pacific and Western Pacific Council meeting in Kona, Hawaii.

Tuna Boats Relay More Than 200 Weather Observations

During May 1979, 22 tuna seiners and 1 research vessel contributed synoptic weather data to the NMFS FAX Advisory Program. A total of 210 weather and 9 XBT observations were reported via the NMFS-licensed radio station WWD. The table below lists data pertaining to program participation during May 1978 and 1979. The numbers of total observations and boats reporting in 1979 are higher than in May 1978.

	May 1978	May 1979
Number of vessels with equipment	53	46
Number of vessels reporting	19	23
Number of weather observation reported	119	210
Number of XBT observation reported	13	9
Total observations	132	219

Leading all program participants during May 1979 were the captains and crews of the Santa Rosa, Maria C J, and Claire P. We thank these people and all other contributors.

Biological Sampling of Foreign Imports of Atlantic Tunas Continues in Puerto Rico

Technician Eugene Holzapfel of the La Jolla Laboratory continues to sample foreign-caught Atlantic tuna for biological information. The fish are among those transshipped to Puerto Rico, where Holzapfel collects data on fork length, weight, and species composition. The research project began in March 1975.

Sampling during the period January through June 1979 was as follows:

Species	Gear	No. of Samples	No. of Fish Sampled	Tonnage Sampled (MT)
Yellowfin	Baitboat	20	1,149	335
Skipjack	Baitboat	6	306	702
	Purse Seine	3	151	1,338
Bigeye	Baitboat	14	626	115
Albacore	Longline	2	81	541
Total		45	2,313	3,031

Weather Data Processing Revamped

Richard Evans, Oceanographer, visited the Monterey Laboratory in June to confer with PEG and Fleet Numerical Weather Central (FNWC) personnel on a number of issues related to environmental data collection and analysis. During the visit, Evans and Dr. Doug McLain of PEG agreed upon display formats of environmental data for a paper they are jointly preparing for presentation at the 1979 International Commission for the Conservation of Atlantic Tunas meetings in Madrid, Spain. The paper will describe those areas of the Atlantic Ocean where environmental parameters indicate potential availability of skipjack tuna to commercial tuna fisheries.

Evans also conferred with LCDR Rogers of FNWC regarding the rerouting of marine weather and expendable bathythermographs (XBT) data. Currently these data are received at the SWFC from purse seiners fishing in the eastern tropical Pacific via the SWFC's radio station, WWD. They are then routed to FNWC for dissemination to data users worldwide. But because of the multiple handling, this scheme increases the chance of error in data fields and slows the dissemination of the information. As a result, Evans and Rogers decided that these data should be routed directly from radio statio WWD to the National Weather Service office in San Diego for dissemination. Both FNWC and the SWFC would then have rapid access to the information via a link to the National Meteorological Center in Washington, D.C.

Dolphin Stock Abundance Workshop Held

A Dolphin Stock Abundance Workshop was held at the Southwest Fisheries Center June 25 and 26. Attending the workshop were specialists in line-transect theory and representatives from the Marine Mammal Commission, Inter-American Tropical Tuna Commission, Living Marine Resources and the National Marine Fisheries Service. Participants presented the results of the 1979 ship and aerial surveys and discussed methodologies to analyze these data. Data obtained from the PBY aircraft, and the research vessels, Jordan and Cromwell, were compared in order to standardize density estimates collected from different platforms. Problems pertaining to school density, mean school size, and proration by species were discussed. A report summarizing the findings of the workshop is being prepared for presentation at the Status of Porpoise Stocks Workshop to be held at the Center August 27-31, 1979.

MARINE MAMMAL ASSESSMENT AND MONITORING

Porpoise Mortality Increases During First Half of 1979

Porpoise kill per set was 28 percent higher in the first half of 1979 than it was for the same period in 1978, as calculated for U.S. boats. An average of 2.99 porpoises was killed per set this year, compared to last year's figure of 2.33. The porpoise kill per ton of yellowfin tuna caught on porpoise was 0.28; for the same period last year, it was 0.21. To date this year, 10,565 porpoises have been killed in purse seining operations.

MARINE BIOLOGY AND TECHNOLOGY

Dall's Porpoise Fishing Casualities Investigated

J. Coe, Fishing Gear Specialist, returned this month from a 4-week research cruise in the North Pacific aimed at characterizing the involvement of Dall's porpoise in the salmon gill net fishery. Coe, Dr. Linda Jones and Chris Boucher of the Northwest and Alaska Fisheries Center (NWAFC), and Bill Walker, a contractor for the National Marine Fisheies Service, participated in the cruise aboard a Japanese research vessel. The NWAFC has started a project to assess the involvement of Dall's porpoise in the fishery to determine the physical causes and to reduce dolphin mortality. Only one porpoise was killed during the research cruise, which netted 25 tons of salmon.

Satellite-Linked Porpoise Tracker Tested

The satellite-linked porpoise tracking system was field tested in Hawaii by Jacqueline Jennings, Ray Stives, and personnel from the National Fisheries Engineering Laboratory. The first transmitter, mounted on a wild Hawaiian spotted dolphin, failed to operate properly, so the second was bench-tested extensively. The problem was an oversensitive seawater switch, designed to deactivate the transmitter when it is underwater. To correct the problem, the researchers added a resistor, and put a delay in the timing circuit. The transmitter will be tested in the lab and the field before being taken back to Hawaii for further field testing there.

Fishing Boats with Misfitted "Super Aprons" Sought

An effort is being made to identify all tuna purse seine vessels with improperly installed "super aprons," a modification of the purse seine desgined to reduce porpoise mortality. The super aprons are to be reinstalled under the direction of the SWFC's gear experts.

TIBURON LABORATORY

FISH COMMUNITIES INVESTIGATION

Ecological Relationships Among Fishes and Plankton Defined

The activities of many fishes are closely tied to the movements of nearshore zooplankters, and these relationships have been a major concern of the Nearshore Fish Communities Task. The more significant of these relationships can be defined by broad generalizations that are valid in both tropical and temperate seas, but which are best studies in the tropics because patterns there, being defined by a greater number of species, are more distinct. In a 1976 study at Enewetak atoll in the Marshall Islands, Dr. Edmund S. Hobson and Fishery Biologist Tony Chess observed a number of relationships (as reported in Fishery Bulletin, 1978, No. 1), and also identified certain questions for further study. More recent studies by other investigators have suggested answers to some of these questions, but Hobson and Chess have doubted the validity of these conclusions.

The major issue concerns the many zooplankters that appear above nearshore reefs after dark, but are absent there in daylight. Based on their earlier work, Hobson and Chess speculated that some reside in or close to the nearshore substrata by day, but that many others migrate shoreward from the deeper waters of the lagoon after rising toward the surfare after dark. They doubted that a significant proportion of those present had come over the seaward reef from the open ocean. Other workers, however, have proposed alternate explanations. Two groups recently reported that zooplankters emerge from nearshore substrata in variety and numbers that could readily account for all the forms above the reefs at night. But in a recent paper (Fishery Bulletin, 1979, No. 1), Hobson and Chess criticized the methods used by these workers and suggested the collections they made probably mixed reef zooplankton with forms from offshore. Another study (as yet unpublished) proposes that a substantial proportion of those zooplankters above the reef at night have, in fact, been swept across the seaward reef from the open ocean.

To resolve these issues, and also to pursue other questions that arose in their earlier work, Hobson and Chess returned to Enewetak for three weeks. They collected plankton day and night in a variety of locations: above the nearshore reefs; in the waters crossing the seaward reef; and in the deeper waters of the lagoon. These collections took into consideration the time of night, moon phase, tidal current, and tide height--all of which influence the occurrence of zooplankton above the nearshore reefs. At the same time, zooplankton that emerged from the nearshore substrata were collected with traps like those used earlier (pictured in Fishery Bulletin, 1979, No. 1, p. 276), modified to sample a variety of substrata (Figure 1). The results of this work generally support the speculations that Hobson and Chess made in their 1978 paper, and also greatly refine our understanding of this dynamic system.

Figure 1. Demersal zooplankter traps in place at Enewetak atoll. Tiburon scientists used these traps to sample organisms that spend part of the time in specific substrata and part of the time in the water column. Three substrates are being sampled here: coral rubble (left), sand (center), and living coral (right).

Another area of study concerned an apparent paradox: the collections Hobson and Chess had made above certain nearshore reefs in 1976 had included relatively few zooplankters. This was consistent with their belief that many zooplankters tend to descend to the deeper waters of the lagoon by day. But these same reefs supported concentrations of planktivorous juvenile and larval fishes that were obviously feeding throughout the day. In considering this puzzling set of circumstances, Hobson and Chess in their 1978 paper speculated that the tendency for zooplankters to seek deeper water by day increases with size, and that in daylight the inshore shallows remain rich in very small forms that passed through the .333 mm mesh of their net. Collections this month with a smaller mesh (.166 mm) confirmed this.

Incidental Catch Problem Examined

Incidental catch of marketable species is a major problem in any multispecies fishery, and particularly in the Pacific otter trawl fishery. If the catches made by the fishery are a mix of several of the important commercial species, then management on a species-by-species basis is impractical. In an attempt to look at the problem of how well the fishery can target on any one species, Peter Adams of the Rockfish Analysis Task examined the species composition of randomly located individual hauls from the 1977 Interagency Rockfish Survey. The analysis showed that for individual species, 50 percent of the catch was taken in about 3 percent of the hauls for rockfish, and about 10 percent of the hauls for flatfish. The catches for rockfish were relatively pure, while the catches of flatfish were much more highly mixed. A directed fishery could be expected to be even more selective than these random hauls.

FISHERIES DEVELOPMENT INVESTIGATION

Rockfish to be Tested as Pet Food

In the continuing development of the shortbelly rockfish fishery, the emphasis has been temporarily switched to the pet food market. Sus Kato, Leader of the Fisheries Development Task, reports that his group is helping a southern California fisherman obtain experimental fishing gear for catching shortbelly rockfish. An order for 10,000 to 20,000 pounds of the fish has been received from a pet food manufacturer who wishes to conduct further feeding tests with cats. It is likely that the fish will also be canned by one or two firms and tested for human consumption.

The Fishery Development Task was informed that Saltonstall-Kennedy Funds have been approved. The money will be used to purchase experimental fishing gear and to finance a trip to Japan for Kato and Dr. Sunee Sonu, Marketing Specialist of the Southwest Region. The primary purpose of the trip is to make a detailed study of west coast seafood's export potential.

Salmon Inoculated, Tagged; Four 1976 Tags Returned

The 150,000 king salmon being held for the Tiburon Laboratory at the Feather River Hatchery were tagged and inoculated against vibriosis. Roger Green's Recreational Fisheries Improvement Subtask group performed the inoculation, while the California Department of Fish and Game did the tagging. Half of the fish are being chemically imprinted to manipulate their homing. The salmon, to be delivered to Tiburon's salt water pends in late July, currently weight about 7 g each.

Four tags were returned this month from king salmon released from Tiburon in 1976. Three of these were late returns from fish caught last year. The other was from a 17-pound salmon caught off Point Reyes, California last month.

PHYSIOLOGY INVESTIGATION

Benzene/Bass Studies Continue

Field sampling and laboratory experiments in the Physiology Investigation at the Tiburon Laboratory were at their busiest during June. Fishery Biologist Mickey Eldridge and Research Chemist Pete Benville completed a series of experiments where striped bass embryos, prefeeding larvae, and feeding larvae were exposed to ^{14}C-labelled benzene at the chronic concentration of 100 ppb. Preliminary results showed significant uptake of benzene in all early life stages. Benzene reduced survival, increased the number of abnormalities, and raised metabolic rates. Effects of benzene exposure were also detected long after the exposures ceased, suggesting that latent effects require attention. Laboratory analyses on growth, energy utilization and histology are now under way. These tests should lead to greater understanding of how aromatic hydrocarbons affect the bass' critical life stages.

Research Associates Nina Hirsch and Richard Pimentel from San Francisco State University began further laboratory research at the Tiburon Laboratory on the effects of prolonged, sublethal benzene exposure on adult striped bass during different stages of sexual maturity. The first of these experiments deals with post-spawning adults. These fish are highly stressed and in generally poor condition in the wild. The researchers hope to determine the extent of their vulnerability to very low benzene concentrations in their weakened condition.

High Incidence of Parasitism, Abnormalities and Wounds Found During Bass Survey

Striped bass in San Francisco Bay are in extremely poor condition this year, according to Fishery Biologist Dr. Jeannette Whipple, and those spawning this year appear to be in worse condition than those in 1978. Whipple presented these findings to the California State Water Resources Control Board and to the California Regional Water Quality Control Board of the San Francisco Bay Region. The bass, collected during their upstream spawning migration, were analyzed by pathological autopsies and tissue analyses. High degrees of parasitism were found in 54 percent; abnormalities occurred in 37 percent, and open wounds were found in 35 percent of the striped bass sampled.

To further the work, Dr. Whipple is now sampling post-spawning adults on their downstream migration. Large numers of striped bass have died in the months of June and July since the late 1940s. The upcoming research is designed to determine whether this die-off is caused by the inability of weakened post-spawning fish to resist the stress of downstream migration. The program staff began sampling adult bass in 1978.

SOUTHWEST REGIONAL DATA MANAGEMENT AND ADP OPERATIONS

Software Development Continues for Onboard Computer ORION

Software development continues for the Oceanographic Research Interactive Onboard Computer (ORION) System aboard the NOAA research vessel David Starr Jordan. The ORION System is a shipboard computer system that will be used to log scientific and navigation data, monitor sensor output for quality control, and perform some data processing. Several meetings were held with the scientific users to determine requirements.

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A computerized Financial Reporting System is operating successfully on the INFONET system at the Southeast Fisheries Center in Miami, at the Northeast Fisheries Center at Woods Hole and at the Southwest Fisheries Center at La Jolla. Additional requirements have been requested by the Northeast Fisheries Center and the documentation to accomplish this is now being written by John Uribarri, representative of the contractor Potomac Research, stationed at the Southwest Fisheries Center.

Work on Plotting Program Begins

The General Services Administration received a contract to design, implement and document a general INFONET DISSPLA plotting package that displays distribution of data on a map grid. The system of programs is intended for use on International Whaling Commission data and by the Marine Mammal Data Management Group. During June, a detailed flowchart was made of the plotting program system, and the specifications for the programs were firmed up and approved.

Vessel Registration File Updated

Oden Burris has updated the California Department of Fish and Game Vessel Registration File. From the updated file, he will make magnetic tapes for the 1974, 1975 and 1976 California commercial landings data and the California vessel data. The tape will be in the format specified by the Coastwide Data System. During June, two COBOL programs to merge the California, Oregon and Washington Commercial Landing files and the vessel files were completed and tested. Two FORTRAN programs were written to create the Summary Data Bases.

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F. Kellenberger, Data Systems Manager, attended a meeting with Dick Heimann of the California Department of Fish and Game on June 15 to discuss contract proposals for implementation of the Fishery Information System (FIS). Required for management and enforcement of the Fishery Conservation and Management Act of 1976, the FIS is designed to collect, process, store, retrieve, and maintain the security of the needed environmental, biological, socioeconomic and legal data. If all goes as planned, a contractor will be selected in August 1979 to begin work on the FIS.

Finding is That Word Processor Not Equipped for Processing Time Cards

The NBI Word Processor in use at the Center is not capable of handling a computerized time card system, according to Systems Analyst Dorothy Roll, who conducted the feasibility study for computerizing time cards. Roll advised that the computer software for a time reporting system would require numerous matrices and code tables in core memory. Since the NBI is a word processor, not a data processor, it cannot carry out the extensive data manipulation required for maintaining time card data. The NBI cannot link to computers, so Ms. Roll said that it would not be possible to keep the data on a host computer and transmit the information to the NBI for time card printing.

Porpoise Data-Group Reviews Documentation

The documentation prepared by Robert Butler, Computer Programmer, on the Data Verification System for Fixed Format Data was given to the Porpoise Data Management Group for its review. The internal/external documentations for the Cruise Specifications and the Vessel Activities editing programs have been accepted as approved by the Porpoise Data Group. This documentation is part of the package for the 1979 porpoise data editing software, designed and implemented by ADP Operations.

Anchovy Biomass Data Tables Completed

Oden Burris, Computer Programmer, has submitted to Gary Stauffer the required tables of the 1951 through 1979 data for the analysis of the anchovy biomass. The tables summarized the data by time periods and by three areas. The time period information does not include data collected during January 1 through February 15 or that of April 1 through April 30. Anchovy data from the 1978 and 1979 cruises were transferred to the UCSD Burroughs system from the data bases on the INFONET system by Rich Charter, CalCOFI data manager. The summary tables for the 28 years of data were generated on the Burroughs system.

Automatic Data Processing Requirements Study Started

Cindie Tashima, PRI consultant, surveyed the computer users at the Southwest Fisheries Center and those in the Southwest Region to see whether the current computer systems are best for future data processing needs. The survey, done by questionnaire and personal interview, was to determine the type of work done on the computer and the amount of computer time needed by each user. Tashima's work is the first step of the Automatic Data Processing (ADP) Requirements Study. Her findings will help ADP staff determine what the most efficient system for the 1980s will be: continued linkage with INFONET and UCSD's computer, their own minicomputer, or other alternatives.

Rick Schmelter from pacific Telephone came to the Center on June 22 to discuss telephone lease lines, which might be employed for future computer links.

MISCELLANEOUS

HONORS AND AWARDS

John Carr is First Recipient of Everett Anderson Award

John Carr, Deputy Director of the NMFS Southwest Fisheries Center in La Jolla, California, was honored recently by the International Association for Great Lakes Research (IAGLR) in Rochester, New York as the first recipient of the Everett-Anderson Award. The award, named after Margaret Everett, former administrative associate of the University of Michigan Great Lakes Research Division and Dr. David Anderson of the University of Toronto Great Lakes Research Division, was initiated this year to recognize the individual who has contributed most significantly to the encouragement of international research on the Great Lakes.

Carr, a Fishery Biologist who has spent almost his entire professional career studying the limnology and fisheries of the Lakes, has played an important role in the founding and continued maintenance of the Association which is an independent U.S.-Canadian organization of scientists involved in research on the Great Lakes.

Myrick Awarded Ph.D.

Wildlife Biologist Dr. Al Myrick received his Ph.D. from UCLA for his dissertation entitled, "Variation, Taphonomy, and Adaptation of the Rhabdosteidae (=Eurhinodelphidae) (Odontoceti, MAMMALIA) from the Calvert Formation of Maryland and Virginia." Myrick's dissertation is being reveiwed for possible publication by the Smithsonian. Dr. Myrick has also completed two papers to be included in the Proceedings of the International Conference on Age Determination of Odontocete and Sirenia. The papers are entitled, "Some approaches to calibration of age in odontocetes using layered hard tissue," and "The use of the Petrographic Microscope in examination of ultrastructure in layered hard tissues of odontocetes."

NOAA Junior Fellow Chosen

Eighteen-year-old Sandra Paez was selected as the 1979 NOAA Junior Fellow for the Southwest Fisheries Center in La Jolla. A 1979 graduate of Kearny High School in San Diego, Paez plans to attend Long Beach State University in the fall as a marine biology major.

The NOAA Junior Fellowship program is designed to give talented, financially disadvantaged students an opportunity to obtain work experience in NOAA facilities while helping them pay their way through college by giving them jobs during their vacation periods.

Paez was chosen from among a group of highly qualified applicants, all of whom were in the top ten percent of their high school classes, as is required by the program.

Sandra will work in the laboratory of Dr. Reuben Lasker helping sort minute plankton for further study. "Working here at the Center gives me a great chance to explore various field in oceanography," she says. "By the time I'm done, I ought to have a good idea of what area of marine biology I'd most like to pursue." Sandra started working at the Southwest Fisheries Center on June 18 in Dr. Jeff Moser's larval fish laboratory.

SEMINARS

La Jolla Laboratory

June 5 - Dr. Daniel Goodman from Scripps Institution of Oceanography gave a talk entitled, "Population Growth Rate Assessment in the Absence of Fecundity Data."

15 - Dr. David H. Cushing, Ministry of Agriculture, Fisheries and Food Fisheries Laboratory, Lowestoft, England, addressed Southwest Fisheries Center scientists. His seminar was called, "A new stock/recruitment model."

28 - Dr. Arvid Pardo, Institute of Marine and Coastal Studies, Universtiy of Southern California, lectured on "Some implications on the emerging law of the sea."

Tiburon Laboratory

June 21 - The fourth joint seminar with San Francisco State University was held at the Tiburon Laboratory. The seminar was presented by Dr. Richard H. Parrish, Pacific Environmental Group, Monterey, and entitled, "Larvae Transport Mechanisms in the California Current."

PRESS RELEASE

June 8 - "National Marine Fisheries Service Scientists Return From Cruise to Northwestern Hawaiian Islands," - Issued by the Honolulu Laboratory.

TRAINING

June 6 - Tina Echeverria, Report Writing - Tiburon Laboratory.

28 - Peter E. Benville, Basic Language for HP-33353 Hewlett Packard - Tiburon Laboratory.

June 29 - Daniel E. Ralph, Statistical Techniques for Analysis. OPH - Tiburon Laboratory.

MEETINGS AND TRAVEL

Honolulu Laboratory

June 6 - Richard Shomura, Director of the Honolulu Laboratory, chaired the 13th meeting of the Scientific and Statistical Committee, WPRFMC, at the Ala Moana Americana Hotel.

- Dr. Michael F. Adams met with economists from the Southwest Fisheries Center and the Southwest Region at the Tiburon Laboratory to draft a report of data needs for NMFS' 5-year data collection plan.

13-30 - Shomura and Dr. Jerry A. Wetherall attended the stock assessment workshop in Shimizu, Japan (June 13-23). Following the workshop, Shomura continued on to Manila, Philippines to attend the Tuna Consultative Data Meeting (June 26-30). Tamio Otsu was Acting Honolulu Laboratory Director during Mr. Shomura's absence.

13 - Hazel S. Nishimura, Librarian, attended the Special Library Association (SLA) Conference at Hilton Hawaiian Village/Ilikai Hotels.

26-27 - Dr. Roy Mendelssohn represented the Honolulu Laboratory Director at the 18th Western Pacific Regional Fisheries Management Council meeting at the Hawaii State Capitol.

La Jolla Laboratory

May 30 - June 1 - A. Coit traveled to Washington, D.C. to attend the NOAA-NMFS 1980 Affirmative Action meeting.

4-8 - J. Squire traveled to Honolulu to initiate integration of billfish and oceanic shark Fishery Management Plan.

- F. Kellenberger traveled to Boulder, CO to attend the National Data Management Committee meeting.

5-8 - J. McMillan traveled to New Orleans to confer with representation of Fish Boat Magazine regarding the construction of new fishing vessels.

6 - A. Alvarino, R. Butler, A. Coan, S. D'Vincent, R. Evans, D. Fellbaum, T. Foster, L. Hansen, J. Henderson, D. Holts, R. Rinaldo, E. Sandknop, B. Stevens, R. Stives, and E. Weber traveled to San Clemente to attend the Fishery Technical Writing Workshop.

June 6-8 - D. Huppert traveled to Tiburon to attend a meeting of economists in the Southwest Region.

6-10 - G. Stauffer traveled to Seattle to attend a U.S.S.R.-U.S. scientific meeting on status of stocks along Pacific coastal states, particularly Pacific hake and jack mackerel.

13-15 - F. Kellenberger traveled to Tiburon and PEG to work on data management activities, and to Sacramento to meet with California Fish and Game personnel on FIS planning.

19-22 - R. Evans traveled to Monterey to consult with Fleet Numerical Weather Central staff about product format-SEASAT contract and to talk with PEG personnel concerning environmental data for the Atlantic.

June 21 - July 3 - R. Lasker traveled to Seoul and Pusan, Korea to participate in U.S./Korean Advisory Meeting in Marine Biology and to Tokyo, Japan to meet with fisheries scientists at the University to Tokyo.

Pacific Environmental Group

June 7 - Dr. Douglas McLain traveled to Tiburon, CA to discuss XBT sampling with PEG's Physical Science Technician assigned at the Tiburon Laboratory and to deliver equipment.

21 - Dr. Richard Parrish traveled to Tiburon, CA to present a seminar on Larvae Transport Mechanisms in the California Current.

25-29 - Gunter Seckel, chief of PEG, traveled to Washington, D.C. to present a technical seminar at the retirement ceremony for Dr. T.S. Austin, Director, Environmental Data Information Services and to meet with personnel at various NOAA components in the Washington area.

Tiburon Laboratory

May 13 - June 9 - Dr. Edmund S. Hobson and Tony Chess traveled to the Mid-Pacific Marine Laboratory, Enewetak, Marshall Islands, to conduct research on trophic relations between fishes and plankton.

June 1 - Ed Ueber chaired the Groundfish Team Meeting held at the Tiburon Laboratory. Dr. William H. Lenarz also attended the meeting.

June 3 - Roger Green, Daniel Ralph, and Susan Smith traveled to Oroville, CA to inoculate the king salmon held for the Tiburon Laboratory at the Feather River Hatchery for later delivery to the Tiburon Laboratory.

4-6 - Director Norman J. Abramson attended the Pink Shrimp Management Plan Development Team Meeting at the California Department of Fish and Game Laboratory, Menlo Park, CA.

7-8 - Ed Ueber attended a meeting of Southwest Fisheries Center and Southwest Region economists to determine data needs for economic research. The meeting was held at the Tiburon Laboratory.

11 - Roger Green and Daniel Ralph traveled to the Feather River Hatchery in Oroville, CA to service the chemical printing drip system for Tiburon's fish held there.

11-13 - Ed Ueber traveled to Portland, OR to chair the Pacific Fishery Management Council's Groundfish Team Meeting. At this meeting the fourth revision of the Groundfish Management Plan was edited and will be submitted to the Council at the July meeting in Los Angeles, CA.

12 - Sus Kato met with Hugh Reilly of West Coast Fishing Development Foundation to discuss development projects at the Tiburon Laboratory.

14 - Norman J. Abramson met with Dr. Erwin Seibel, Director, Tiburon Center for Environmental Studies, San Francisco State University.

18 - Norman J. Abramson, William Leet, and Thomas Yocom attended the Salmon Enhancement Meeting in San Francisco. Governor Jerry Brown was the featured speaker at this meeting.

22 - Dr. Jeannette A. Whipple, Maxwell B. Eldridge, and Pete Benville attended a closed hearing before the Water Quality Control Board of the San Francisco Bay Region. At this hearing, Whipple gave a presentation on the Tiburon Laboratory's research relating to the striped bass issue.

26-30 - Sus Kato traveled to southern California to meet with processors, fishermen and researchers. The chief purpose of the trip was to aid a fisherman in gearing-up for fishing shortbelly rockfish, and to plan the upcoming trip to Japan with Sunee Sonu of the Southwest Region.

28 - Roger Green traveled to Oroville, CA to service the chemical imprinting drip system and to arrange the logistics for the king salmon delivery to Tiburon with Manager of the Feather River Hatchery.

VISITORS

Honolulu Laboratory

June 1 - Elise Dorman, NMFS/TIMS, Galveston, Texas.

4 - John C. Marr, Executive Director, WPRFMC, visited Tamio Otsu.

- Dick Okada, U. Okada and Co., Honolulu, visited Otsu.

5 - Toshiaki Shirasawa, Japan Marine Fisheries Resource Research Center (JAMARC), visited Otsu.

7 - Rich Howell, a visitor from Guam, discussed fisheries data with Mr. Otsu.

8 - Dr. Yoshiaki Matsuda, East West Center visiting scientist, visited Otsu.

11 - Otsu met with Dr. Jed Hirota, Hawaii Institute of Marine Biology, UH.

13 - Carolyn Brown, Library of Information Services Division, NOAA, who was in Honolulu for the SLA Conference, visited Hazel Nishimura and George T. Liao.

18 - Peter Walczak, FAO/UNDP, Tarawa, Gilbert Islands.

20 - J.P. Alexander, who is in charge of the Technical Library of the International Center for Marine Resources Development at the University of Rhode Island (URI) in Kingston, visited Nishimura. Dr. Lewis Alexander, also of URI, visited the library. Alexander, who was formerly in charge of the Law of the Sea Institute at URI, is visiting the East West Center as a consultant.

22 - Dr. Mervin Yetley, Texas A&M University, visited Otsu.

La Jolla Laboratory

June 1 - Arthur McEvy, UC, San Diego.

7 - H. Edwards, Pyramid Aviation, Long Beach.

13 - S.J. Sanfro, DATAMAX.

14 - Pierre Chan, Geneva, Switzerland.

- Mary Price, Smithsonian representative, Ft. Pierce, FL.

June 25 - Dr. Paul Webb, University of Michigan, the newly selected NOAA Fellow in 1979-80 who will work at the Center in the upcoming months, is an expert in fish hydrodynamics and fish energetics.

26 - Edward De Fabo, Environmental Protection Agency, visited John Hunter to discuss proposed research on the effect of ultraviolet light on anchovy recruitment.

Pacific Environmental Group

June 14 - Cindie Tashima, Potomac Research Inc., La Jolla, CA.

- Fred Kellenberger, NMFS, La Jolla, CA.

20 - Dick Evans, NMFS, La Jolla, CA.

26 - Herb Jaenicke, NMFS, Auke Bay, AK.

28 - Bob Nishimoto, NMFS, La Jolla, CA.

Tiburon Laboratory

June 7 - Michael Adams, NMFS, Honolulu Laboratory, Honolulu, HI.

- Joe Dworian, Inplace Systems Corporation, Hayward, CA.

- Dan Huppert, Southwest Fisheries Center, NMFS, La Jolla, CA.

- Jack Manska, Whitney Association, Concord, CA.

- Douglas McLain, Pacific Environmental Group, NMFS, Monterey, CA.

- Wesley Silverthorne, Southwest Region, NMFS, Terminal Island, CA.

8 - Fred H. Todd, Commercial Fisherman, Tiburon, CA.

11 - David K. and Elizabeth Bickford, San Diego, CA.

- Cindie Tashima, PRI, La Jolla, CA.

12 - Hugh Reilly, Horizon Trawlers, Inc., Corte Madera, CA.

13 - Morgan J. Griffith, San Francisco State University, San Francisco, CA.

14 - Susan Tanaka, Waipohu, HI.

- Susan Wong, Waipohu, HI.

18 - Blair Vedder, Evanston, IL.

June 19 - Matt Freidman, San Francisco State University, Burlingame, CA.

- Paul McGregor, San Francisco State University, San Rafael, CA.

- William Hoeckle, Humboldt State University, Arcata, CA.

- Rich Martz, San Francisco State University, San Rafael, CA.

- Jim McHugh, San Francisco State University, San Francisco, CA.

- Betsy Schulz, San Francisco State University, Oakland, CA.

- Mobashir A. Solangi, Gulf Coast Research Laboratory, Ocean Springs, MS.

- Alice Straus, San Francisco State University, Tiburon, CA.

- Shim Weng, San Francisco State University, Daly City, CA.

21 - M. Bradbury, San Francisco State University, San Francisco, CA.

- Dale E. Bretschneider, Pacific Environmental Group, NMFS, Monterey, CA.

- Gerald Bowers, State Water Resources Control Board, Sacramento, CA.

- David Frydenlund, U.S. Coast Guard, San Francisco, CA.

- Julie G. Graff, Ecological Analysts, Inc., Concord, CA.

- Sue Hatfield, California Department of Fish and Game, Menlo Park, CA.

- John Icanberry, Pacific Gas & Electric, San Ramon, CA.

- James H. Mullick, San Francisco, CA.

- Richard H. Parrish, Pacific Environmental Group, NMFS, Monterey, CA.

- Paul Reilly, California Department of Fish and Game, Menlo Park, CA.

- Stan Rice, Auke Bay Fisheries Laboratory, Auke Bay, AK.

- Dave Thomas, California Department of Fish and Game, Menlo Park, CA.

- Birgit Winning, Steinhart Aquarium, California Academy of Sciences, San Francisco, CA.

29 - Bob Melrose, NOAA-NWS, Cristobal, Canal Zone.

PERSONNEL

Honolulu Laboratory

June 1 - Roy R. Sasaki, Biological Aid (Microbiology) - Completion of 700-h appointment.

4 - Laurie Tsuji, Computer Technician - 700-h appointment NTE 9/29.

10 - Linda C. Hubbell, Biological Aid (Fisheries) - 700-h appointment NTE 9/29.

15 - Linda M. Paul, Biological Aid (Fisheries) - Termination/ Completion of duties for which hired.

La Jolla Laboratory

April 6 - James Cotton, Biological Technician - Resignation.

May 25 - Deanna Olson, Biological Technican - Resignation.

May 31 - Valerie Spowart, Cash & Attendance Clerk - Resignation.

June 8 - Frank Iorio, Computer Specialist - Resignation.

17 - William Sullivan, Cash & Attendance Clerk - Career-Conditional Appointment.

18 - Jay Barlow - Graduate Student Appointment.

July 1 - Robert Salomons, Biological Technician - Expiration of appointment.

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